can be made by migrating birds, without leading them out of view of their destination. With shorter journeys it is evident the error of flight may be largely increased without endangering the safety of the migrants.

Migratory birds that are strictly nocturnal cannot cross any very great expanse of barren ocean, hence, unless their error of flight is large, and the land they wing their way to small, there is not much fear of their losing themselves. Moreover, if they do go wrong, dawn must assuredly bring back their powers of vision. E. H. PRINGLE

Beckenham, April 27

An Observatory of Newton's?

THERE is a tradition associated with a domed building, now covered with ivy, situate on Stamford Hill, that it was once employed as an observatory by Sir Isaac Newton. Can any of your readers give any information upon the subject? Immediately beneath the revolving dome there is a well-shaped excavation (now partially filled with water) in which is an extinguisher-shaped stand, supposed to be of iron; this may have formed part of the base of a telescope, but no information upon the subject can be obtained from the local inhabitants. CHARLES COPPOCK

Grosvenor Road, Highbury New Park, N., April 23

Waterton's Wanderings—Goat-suckers

ONE would like further information respecting the "nocturnal flies" which settle on the udders of cows or goats, and may be seen on moonlight nights. Many lepidoptera and coleoptera and a few hymenoptera are nocturnal, but are not known to adopt the habit described. Of the true flies, diptera, are any nocturnal? HENRY H. HIGGINS

A STATUE TO CAPTAIN COOK

THE Australians have found a hero worthy of their worship, and Capt. Cook has at length found an English-speaking people eager to take occasion to honour the memory and the work of one of the greatest of Englishmen. The mystery of the reticence of our wealthy but unwieldy Geographical Society on the occurrence of the centenary of Cook's death, still remains unsolved; they did not even send a representative to Paris, to the amazement of the enthusiastic French geographers; was the weather too rough for the gallant admiral who we believe volunteered to the indifferent Council to go to the Paris meeting? We are glad for the credit of the nation that it has not been left entirely to the foreigner to recognise the greatness of one of England's greatest navigators and discoverers. Our readers may remember that some time since a statue of Cook adorned Waterloo Place, near the Athenæum Club. The statue was admitted to have been exceedingly happy in conception, and successful in execution; it is supposed to represent the great navigator coming within the loom of the east Australian coast, which he first saw near Cape Howe, to the south of Sydney. It was for this city that the statue was designed, and it was to inaugurate the work of Mr. Woolner, that on February 25 last one of the greatest demonstrations took place that has been witnessed in Australia since the first shipload of convicts was landed at Botany Bay. When we said that Australia had found a hero, perhaps we spoke too widely, for only New South Wales as represented by Sydney, seems to have joined in the demonstration to commemorate the centenary of Cook's tragic end and the unveiling of his statue. It seems to us a great thing for a people to have a worthy national hero, and since the days when Abraham begat Isaac, and probably long before, every nation of any note has had its hero or demigod in whom all the national virtues have been embodied. The Australians have the making of a great people among them, and while they have a right to count our gods as theirs, still no doubt they would like to have a Hengist of their own to mark a new starting-point in their history. Happily, as we have said, they have found a worthy one—one whose character is in every respect worthy of their admiration, and the principles of whose conduct, if adopted and acted upon, will help to make of them a really great people. However desirable we may think the federation of our Australian colonies to be, any advocacy of it in these pages would be out of place. Still we cannot but think that it would have been a good thing in many ways—a good thing for the colonies themselves, and conducive to cordiality among them—had they all united to do honour to one so worthy of honour in all respects, and to whom, in a sense, they are indebted for their very existence.

Nothing could have been more successful than the gathering in Sydney on February 25, to assist at the unveiling of the statue by Sir Hercules Robinson. It was a universal holiday. Probably there were not much less than 100,000 people gathered in and around Hyde Park at the time of the opening ceremony—people of all classes who had voluntarily given up their work or business for the day, apparently, to a large extent, from genuine enthusiasm towards the man who first landed near the site of what in a few years has become one of the finest cities in the world. The statue seems to have given universal satisfaction, and the enthusiasm reached its height when Sir Hercules Robinson unveiled it at the conclusion of a solid and suitable speech. In his address the Governor traced in a sympathetic manner the career of the hero whom they had gathered to honour, from his birth as a peasant's son, till his unfortunate murder at Hawaii. Sir Hercules does not, however, seem to be well up in the latest evidence with regard to Cook's death, and seems, as of old, to have attributed it to mere savagery, whereas it seems pretty clearly ascertained that it was a blunder on the part of the poor natives. We have so recently written on the character and work of Cook, that it is unnecessary again to go over the same ground. Sir Hercules very happily, we think, read the moral of Cook's life to the people of Sydney. He was a man who eagerly pursued knowledge as his scanty opportunities afforded: who valued science, and endeavoured to do all his work by its light and guidance; who treated those under his command with the greatest consideration, and exercised the utmost tenderness and humanity towards the natives of the various islands with which he had any dealings. "Such a statue is creditable to ourselves," Sir Hercules justly concluded, "as marking our admiration of the character and services of the man, and our gratitude for the benefits which his discoveries have conferred, not only on Australia, but also on the world at large. . . . There is scarcely a lad born in this country who has not within his reach educational advatages superior to those which were available to the poor Yorkshire peasant boy, and I hope that the history of his early life may not be thrown away upon the young, but that many a child in the future will learn at the foot of this statue how a faithful, patient, cheerful attention to the details of daily duty, however monotonous and commonplace, will bring its own reward, and may perchance, as in the case of James Cook, leave behind a noble and imperishable memory."

While we regard it as right and proper that this fine statue should have been erected in Sydney to Cook, we think, moreover, the people of New South Wales would only be carrying out the work of Cook if they took some step to obtain a more thorough knowledge of these Pacific islands and seas, for a knowledge of which Cook did so much. We recently referred to the lecture given them by Dr. Miclucho Maclay on the want of a zoological station at Sydney; and we would suggest that the people of Sydney, helped by the other Australian cities, should carry out the work they have so well begun, by founding an institution, that under proper guidance would add immensely to our knowledge of the life of these interesting

waters. Meanwhile let us be thankful that they have done something to redeem the race to which Cook belonged from the charge of insensibility to his greatness.

THERMO-CHEMICAL INVESTIGATION

THE introduction of a new method of research, or the invention of a new instrument, has repeatedly marked an epoch in the development of more than one branch of natural science. The last few years have witnessed the introduction into chemical research of a new method of examining chemical changes, a method which is founded upon the study of those thermal reactions which accompany these changes.

The older methods of chemical investigation failed to throw any definite light upon many important problems, some at least of which have been brought a step nearer complete solution by the application of the newer method of thermo-chemical measurement.

When solutions of two salts are mixed, the products of the mutual action of which salts remain in solution under the experimental conditions, it is frequently found impossible to determine, by means of the ordinary analytical processes, the chemical distribution of the mass of reacting matter at the expiry of the experiment.

Again, there are certain acids which undoubtedly form two series of well-marked salts, but which appear to be capable, under certain ill-defined conditions, of forming a third series of unstable saline derivatives. How to determine the basicity of such acids has long been one of the unsolved problems of chemistry.

Once more, the ordinary methods of investigation have failed to supply us with any far-reaching generalisation concerning the stabilities of series of compounds. Certain relations have undoubtedly been traced between general chemical properties of compounds, the properties of their constituent elements, and the stability of these compounds, but, nevertheless, the shadowing forth of well-marked generalisations, connecting stability of compounds with chemical structure, from which generalisations exact deductions, capable of experimental investigation, might be made, dates from the introduction of the thermo-chemical method of investigation.

That system of notation which is now employed in chemistry, although of the greatest value, is nevertheless far from being perfect; it fails to tell anything concerning the changes in forms of energy involved in those changes of distribution of mass which it formulates. Previous to the introduction of the thermo-chemical method little or no exact knowledge regarding these changes of energy was in the possession of chemists.

Chemists were long aware that certain reactions were possible only under stated conditions of temperature, pressure, &c., but until measurements had been made of the amounts of heat evolved or absorbed in these reactions they were unable to generalise the connection between the conditions of the reactions and the possibility of their occurrence.

Such are some of the problems which have been at least partially solved by the new method.

The fundamental position of thermal chemistry may be thus stated: "Every chemical change taking place without the aid of extraneous forces tends to produce that body, or system, in the formation of which the greatest evolution of heat occurs."

As a deduction from this statement Berthelot formulates his law of maximum work as follows:—"That salt, the formation of which is attended with the greatest evolution of heat, is always produced when those salts, from whose mutual action it may be formed, exist in solution in a condition of partial decomposition."

Many special instances illustrative of these generalisations might be cited; let one or two suffice. Chlorine decomposes dry sulphuretted hydrogen with formation of hydrochloric acid and separation of sulphur; iodine does not decompose sulphuretted hydrogen under the same conditions. The formation of hydrochloric acid and sulphur in the first change is accompanied with the evolution of a considerable quantity of heat; the formation of hydriodic acid and sulphur, in the second case, would involve the absorption of much heat. If, however, the action of extraneous forces be allowed to supervene, a new condition of equilibrium is attained; add water to sulphuretted hydrogen and iodine, hydriodic acid and sulphur are produced. But the solution in water of hydriodic acid, which is the potential product of the reaction, involves the evolution of more heat than is absorbed in the reaction itself.

Iodine scarcely decomposes water, but if sulphurous acid be added to water, iodine is capable of bringing about decomposition, the products of the reaction being hydriodic and sulphuric acids

$$(H_2O + I_2 + H_2SO_3 = H_2SO_4 + 2HI).$$

Now it is found that the formation of sulphuric from sulphurous acid is accompanied with the evolution of a considerable amount of heat; if, then, the decomposition formulated $2H_2O + 2I_2 = 4HI + O_2$ be started, the combination of the oxygen thus produced with the sulphurous acid present causes the evolution of more heat than would be evolved in any other series of chemical changes which could occur among the bodies present.

The applications of the thermal method in general chemistry are many and important. I propose briefly to consider some of the results obtained by this method, as shown in the phenomena attending the neutralisation of acids; in the changes which occur on mixing solutions of two salts which are capable of undergoing decomposition with the production of salts themselves soluble under the conditions of experiment; in the measurements of (so-called) affinities between elementary bodies; and in one or two other reactions of general interest.

The neutralisation of an acid by an alkali is attended with the evolution of a constant amount of heat; in some cases it is noticed that the total amount of heat evolved is independent of the relative quantities of acid and alkali employed, while in other cases the total heat evolution may be divided into two equal portions, one half of the whole accompanying the addition of the first portion, and one-half accompanying the addition of the second portion of alkali. Those results evidently point to the exhaustion of the available energy of the acid (or alkali) as a phenomenon which takes place in regular stages. The thermal results of neutralisation phenomena are rendered more intelligible when we find that an acid, the neutralisation of which is accompanied with the evolution of but one quantity of heat, is also a monobasic acid; while in the case of a dibasic acid the total amount of heat evolved on neutralisation with alkali is divisible into two distinct portions. Further, a difference is traceable between the thermal phenomena which attend the neutralisation of an acid by caustic potash or soda, on the one hand, and by ammonia on the other.

The reaction formulated

$$2KHO + H_2SO_4 = K_2SO_4 + 2H_2O,$$

involves the expenditure of 31,000 thermal units; but the reaction2 $NH3 + H_2SO_4 = (NH_4)_2SO_4$ is attended with the expenditure of but 28,150 thermal units

If, however, a compound more strictly comparable with caustic potash in its chemical structure be employed to neutralise sulphuric acid, we find that the heat evolved is equal in both cases; the reaction

$$2N(CH_3)_4OH + H_2SO_4 = (N(CH_3)_4)_2SO_4 + 2H_2O,$$

is attended with the evolution of 31,300 thermal units.

From the point of view of their thermal reactions, the alkalis (including thallium hydroxide) and the alkaline earths, are strictly equivalent, so far as the power of